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ANNOTATED BIBLIOGRAPHY OF SELECTED PUBLISHED AND UNPUBLISHED WORKS ON BILLFISH, MAHIMAHI, WAHOO, AND SHARKS

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CONTENTS

INTRODUCTION

Since 1976, when the Western Pacific Regional Fishery Management Council (Council) first began developing a fishery management plan for billfish and assorted large pelagic species taken by longline gear in the U.S. Fishery Conservation Zone around Hawaii and other U.S. possessions in the Pacific, a number of studies have been undertaken by the Southwest Fisheries Center, Honolulu Laboratory (SWFC) in support of the Council. The scope of the fishery management plan has since changed. Other species, mahimahi, wahoo, and sharks, have been included, dropped, and then reintroduced. Tuna longline gear is now regarded as becoming less important and gill nets, purse seine, deep-sea handline (ika-shibi), and other gear are becoming progressively more important. As a consequence, the Council has asked the SWFC to provide a summary of studies carried out by the SWFC that could be used to improve the current version of the draft fishery management plan.

The purpose of this paper is to provide sources of information on billfish, mahimahi, wahoo, and sharks to support the development of a final fishery management plan for these large pelagic species by the Council and its associated bodies.

This bibliography deals with documents authored by the SWFC staff or prepared by others for activities sponsored by the SWFC. Abstracts of references marked with an asterisk (*) were reproduced in total from the original. All other abstracts were condensed or excerpted.

Sources include formal publications, Special Scientific Reports--Fisheries (SSRF), and Administrative Reports.

Research conducted by SWFC has focused on areas other than mahimahi, wahoo, and sharks; therefore, there are only a limited amount of publications in this area.

SPECIES IDENTIFICATION

de Sylva, D. P., and S. Ueyanagi.
1974. Comparative development of Atlantic and Mediterranean billfishes (Istiophoridae). (Abstr.) In R. S. Shomura, and F. Williams (editors), Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972, Part 2. Review and Contributed Papers, p. 79. U.S. Dep. Commer., NOAA Tech. Rep. NMFS SSRF-675.

Fierstine, H. L.
1974. The paleontology of billfish--The state of the art. In R. S. Shomura and F. Williams (editors), Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972, Part 2. Review and Contributed Papers, p. 34-44. U.S. Dep. Commer., NOAA Tech. Rep. NMFS SSRF-675.

*The major osteological features are described for living billfishes. All billfish remains are reviewed critically and some questionable forms are placed in Xiphioidei Incertae Sedis (uncertain status). The remaining xiphioids are placed into three families: Istiophoridae, Xiphiidae, and Xiphioirhynchidae. A new undescribed xiphiid from Mississippi shows that the billfish lineages must have diverged prior to the Eocene. Areas of research are suggested that will help place the paleontological studies on a more secure foundation.

Nakamura, I.

1974. Some aspects of the systematics and distribution of billfishes. In R. S. Shomura and F. Williams (editors), Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972, Part 2. Review and Contributed Papers, p. 45-53. U.S. Dep. Commer., NOAA Tech. Rep. NMFS SSRF-675.

Key, with figures, is presented which includes 2 families, 4 genera, and 11 species. The worldwide distribution of billfishes is given; distributions are based primarily on data from the Japanese longline catch for 1964-69.

Richards, W. J.

1974. Evaluation of identification methods for young billfishes. In R. S. Shomura and F. Williams (editors), Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972, Part 2. Review and Contributed Papers, p. 62-72. U.S. Dep. Commer., NOAA Tech. Rep. NMFS SSRF-675.

Most of the papers published from 1831 to date which deal with the identification of young billfishes (Families Xiphiidae and Istiophoridae) are reviewed. The present knowledge of the identification of adults is compared with the identification of young and problem areas are defined. Suggestions are made to resolve the problems encountered with the identification of the young stages (egg, larvae, and juveniles).

Robins, C. R.

1974. The validity and status of the roundscale spearfish, Tetrapturus georgei. In R. S. Shomura and F. Williams (editors), Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972, Part 2. Review and Contributed Papers, p. 54-61. U.S. Dep. Commer., NOAA Tech. Rep. NMFS SSRF-675.

A fourth Atlantic species of the istiophorid genus Tetrapturus was discovered in 1961 among commercial catches landed in Sicily, Portugal, and Spain. The species is described in detail.

Ueyanagi, S.
1974. On an additional diagnostic character for the identification of billfish larvae with some notes on the variations in pigmentation. In R. S. Shomura and F. Williams (editors), Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972, Part 2. Review and Contributed Papers, p. 73-78. U.S. Dep. Commer., NOAA Tech. Rep. NMFS SSRF-675.

The identification of billfish larvae has depended on such characteristics as the shape of the pectoral fin, pigmentation of the branchiostegal membrane, pigmentation of the lower jaw membrane, and head profile. Recent studies have resulted in additional diagnostic characters which differentiate between the striped marlin and blue marlin under 7 mm.

LIFE HISTORY

Beckett, J. S.
1974. Biology of swordfish, Xiphias gladius L., in the northwest Atlantic Ocean. In R. S. Shomura and F. Williams (editors), Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972, Part 2. Review and Contributed Papers, p. 103-106. U.S. Dep. Commer., NOAA Tech. Rep. NMFS SSRF-675.

The present knowledge of the biology of swordfish in the northwest Atlantic Ocean is summarized.

de Sylva, D. P.
1974. Life history of the Atlantic blue marlin, Makaira nigricans, with special reference to Jamaican waters. (Abstr.) In R. S. Shomura and F. Williams (editors), Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972, Part 2. Review and Contributed Papers, p. 80. U.S. Dep. Commer., NOAA Tech. Rep. NMFS SSRF-675.

Eldridge, M. B., and P. G. Wares.
1974. Some biological observations of billfish taken in the eastern Pacific, 1967-1970. In R. S. Shomura and F. Williams (editors), Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972, Part 2. Review and Contributed Papers, p. 89-101. U.S. Dep. Commer., NOAA Tech. Rep. NMFS SSRF-675.

From 1967 through 1970 sport-caught billfishes were sampled at Mazatlan, Sinaloa; and Buena Vista, Baja California, and at San Diego, California. Lengths, weights, morphometrics, meristics, and gonad data were collected on a total of 2,056 striped marlin, 821 sailfish, 61 blue marlin, and 1 black marlin. This paper presents information on reproduction, average length

and condition factor, food habits for 1970, and notes on parasites.

Hanamoto, E.
1974. Fishery-oceanographic studies of striped marlin, Tetrapturus audax, in waters off Baja California. 1. Fishing conditions in relation to the thermocline. In R. S. Shomura and F. Williams (editors), Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972, Part 2. Review and Contributed Papers, p. 302-308. U.S. Dep. Commer., NOAA Tech. Rep. NMFS SSRF-675.

In this report, the author analyzed fishing conditions for striped marlin in waters off Baja California in relation to the thermocline.

Iversen, R. T. B., and R. B. Kelley.
1974. Occurrence, morphology, and parasitism of gastric ulcers in blue marlin, Makaira nigricans, and black marlin, Makaira indica, from Hawaii. In R. S. Shomura and F. Williams (editors), Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972, Part 2. Review and Contributed Papers, p. 149-153. U.S. Dep. Commer., NOAA Tech. Rep. NMFS SSRF-675.

Gastric ulcers were found in 10 of 14 blue marlin, Makaira nigricans, and 2 of 3 black marlin, M. indica, examined from 1967 to 1969 at the Hawaiian International Billfish Tournament. Parasitic nematodes were found imbedded in the base of ulcers in one blue marlin and two black marlins.

Jolley, J. W., Jr.
1974. On the biology of Florida east coast Atlantic sailfish (Istiophorus platypterus). In R. S. Shomura and F. Williams (editors), Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972, Part 2. Review and Contributed Papers, p. 81-88. U.S. Dep. Commer., NOAA Tech. Rep. NMFS SSRF-675.

Attempts are being made to estimate sailfish age using concentric rings in dorsal fin spines. If successful, growth rates will be determined for each sex and age of initial maturity described.

Lenarz, W. H., and E. L. Nakamura.
1974. Analysis of length and weight data on three species of billfish from the western Atlantic Ocean. In R. S. Shomura and F. Williams (editors), Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972, Part 2. Review and Contributed Papers, p. 121-125. U.S. Dep. Commer., NOAA Tech. Rep. NMFS SSRF-675.

*Estimates of parameters of relations among weight, girth, total length, fork length, trunk length, and caudal spread were made for blue marlin, white marlin, and sailfish captured in the western Atlantic.

Markle, G. E.
1974. Distribution of larval swordfish in the northwest Atlantic Ocean. In R. S. Shomura and F. Williams (editors), Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972, Part 2. Review and Contributed Papers, p. 252-260. U.S. Dep. Commer., NOAA Tech. Rep. NMFS SSRF-675.

Surface plankton collections, mostly with neuston nets towed at 4-5 knots, during eight cruises (1965-72) yielded 119 swordfish larvae, 6-110 mm total length.

Mather, C. O.
1974. Scientific billfish investigation: present and future; Australia, New Zealand, Africa. (Abstr.) In R. S. Shomura and F. Williams (editors), Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972, Part 2. Review and Contributed Papers, p. 102. U.S. Dep. Commer., NOAA Tech. Rep. NMFS SSRF-675.

Mather, F. J., III, J. M. Mason, Jr., and H. L. Clark.
1974. Migrations of white marlin and blue marlin in the western North Atlantic Ocean--tagging results since May 1970. In R. S. Shomura and F. Williams (editors), Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972, Part 2. Review and Contributed Papers, p. 211-225. U.S. Dep. Commer., NOAA Tech. Rep. NMFS SSRF-675.

Migrations of white marlin, Tetrapturus albidus Poey, and blue marlin, Makaira nigricans Lacépède, in the western North Atlantic Ocean are discussed in terms of tag returns obtained since the completion of data collection for the paper by Mather et al. (1972) in May 1970. [Mather, F. J., III, A. C. Jones, and G. L. Beardsley, Jr. 1972. Migration and distribution of white marlin and blue marlin in the Atlantic Ocean. Fish. Bull., U.S. 70:283-298.]

Mather, F. J., III, D. C. Tabb, J. M. Mason, Jr., and H. L. Clark.
1974. Results of sailfish tagging in western North Atlantic Ocean. In R. S. Shomura and F. Williams (editors), Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972, Part 2. Review and Contributed Papers, p. 194-210. U.S. Dep. Commer., NOAA Tech. Rep. NMFS SSRF-675.

Migrations of sailfish, Istiophorus platypterus (Shaw and Nodder), in the western North Atlantic Ocean are discussed on the basis of results of three cooperative tagging programs.

Matsumoto, W. M., and T. K. Kazama.
1974. Occurrence of young billfishes in the central Pacific Ocean. In R. S. Shomura and F. Williams (editors), Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972, Part 2. Review and Contributed Papers, p. 238-251. U.S. Dep. Commer., NOAA Tech. Rep. NMFS SSRF-675.

Plankton and other net-caught samples collected on cruises of the National Marine Fisheries Service, Honolulu Laboratory vessels in Hawaiian and central Pacific equatorial waters were examined for billfish larvae and juveniles. Species recognized were: blue marlin, Makaira nigricans; shortbill spearfish, Tetrapturus angustirostris; sailfish, Istiophorus platypterus; swordfish, Xiphias gladius.

Nishikawa, Y., and S. Ueyanagi.
1974. The distribution of the larvae of swordfish, Xiphias gladius, in the Indian and Pacific Oceans. In R. S. Shomura and F. Williams (editors), Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972, Part 2. Review and Contributed Papers, p. 261-264. U.S. Dep. Commer., NOAA Tech. Rep. NMFS SSRF-675.

The distribution of larval swordfish, Xiphias gladius, was determined on the basis of 325 specimens collected from Japanese research vessels operating in the Indian and Pacific Oceans. These larvae, ranging from 3 to 160 mm in total length, were caught by larval-net tows and by dip netting.

Penrith, M. J., and D. L. Cram.
1974. The Cape of Good Hope: A hidden barrier to billfishes. In R. S. Shomura and F. Williams (editors), Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972, Part 2. Review and Contributed Papers, p. 175-187. U.S. Dep. Commer., NOAA Tech. Rep. NMFS SSRF-675.

Since 1838 there have been isolated reports of billfishes from the southern tip of Africa, but only during the years 1961-64, when a number of Cape Town based boats fished commercially for tuna using longline, were billfishes found to occur in considerable numbers.

Robins, C. R.
1974. Summer concentration of white marlin, Tetrapturus albidus, west of the Strait of Gibraltar. In R. S. Shomura and F. Williams (editors), Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972, Part 2. Review and Contributed Papers, p. 164-174. U.S. Dep. Commer., NOAA Tech. Rep. NMFS SSRF-675.

Examination of fish catches landed in August 1961 at various parts in southern Portugal and the adjacent coast of Spain demonstrated that the white marlin, Tetrapturus albidus, concentrated in these waters during this month.

Royce, W. F.
1957. Observations on the spearfish of the central Pacific. U.S. Fish Wildl. Serv., Fish. Bull. 57:1-554.

The taxonomy, distribution, size, food, and spawning habits of spearfish are considered. Observations on several hundred spearfishes caught in the central equatorial Pacific and in the Hawaiian fishery are presented, together with an extensive review of Japanese and other literature. Species recognized are: swordfish, Xiphias gladius; shortbill spearfish, Tetrapturus angustirostris; sailfish, Istiophorus orientalis; black marlin, Istiompax marlina; striped marlin, Makaira audax; and Pacific blue marlin, Makaira ampla.

Scott, W. B., and S. N. Tibbo.
1974. Food and feeding habits of swordfish, Xiphias gladius Linnaeus, in the northwest Atlantic Ocean. In R. S. Shomura and F. Williams (editors), Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972, Part 2. Review and Contributed Papers, p. 138-141. U.S. Dep. Commer., NOAA Tech. Rep. NMFS SSRF-675.

Food and feeding habits of swordfish were studied by examining stomachs of 141 individuals captured from July to October 1971 between the Grand Bank and the southeast part of Georges Bank in the Northwest Atlantic Ocean.

Skillman, R. A., and M. Y. Y. Yong.
1974. Length-weight relationships for six species of billfishes in the central Pacific Ocean. In R. S. Shomura and F. Williams (editors), Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972, Part 2. Review and Contributed Papers, p. 126-137. U.S. Dep. Commer., NOAA Tech. Rep. NMFS SSRF-675.

The weight-length relationship for six species of billfishes in the central Pacific Ocean were developed. Species recognized were: blue marlin, Makaira nigricans; sailfish, Istiophorus platypterus; black marlin, M. indica; shortnose spearfish, Tetrapturus angustirostris; striped marlin, T. audax; and swordfish, Xiphias gladius.

Skillman, R. A., and M. Y. Y. Yong.
1976. Von Bertalanffy growth curves for striped marlin, Tetrapturus audax, and blue marlin, Makaira nigricans, in the North Pacific Ocean. Fish. Bull., U.S. 74:553-566.

The growth of striped marlin and blue marlin was described by fitting von Bertalanffy growth curves to the progression of age-groups, by quarters, in the Hawaiian longline fishery from 1960 to 1970.

Squire, J. L., Jr.
1974. Catch distribution and related sea surface temperature for striped marlin (Tetrapturus audax) caught off San Diego, California. In R. S. Shomura and F. Williams (editors), Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972, Part 2. Review and Contributed Papers, p. 188-193. U.S. Dep. Commer., NOAA Tech. Rep. NMFS SSRF-675.

Records for 4,535 striped marlin landed at San Diego, California and sea surface temperature data were examined for the period 1963 through 1970 to determine time-space distribution of striped marlin and the relationship of catch and sea surface temperature. Sea surface temperature conditions relative to increased catches were also compared.

1974. Migration patterns of Istiophoridae in the Pacific Ocean as determined by cooperative tagging programs. In R. S. Shomura and F. Williams (editors), Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972, Part 2. Review and Contributed Papers, p. 226-237. U.S. Dep. Commer., NOAA Tech. Rep. NMFS SSRF-675.

During 1954-71, 15,540 billfish were taggged. Records show 9,849 striped marlin, Tetrapturus audax; 4,821 sailfish, Istiophorus platypterus; 622 black marlin, Makaira indica; and 248 blue marlin, M. nigricans were tagged during this period.

Strasburg, D. W.
1969. Billfishes of the central Pacific Ocean. U.S. Fish Wildl. Serv., Circ. 311, 11 p.

Information on diet, sex ratio, sexual dimorphism, seasonal occurrence, spawning, early life history and growth, migrations, and length-weight relations are discussed. Species discussed were blue marlin, Makaira nigricans; black marlin, M. indica; striped marlin, Tetrapturus audax; shortbill spearfish, T. angustirostris; Pacific sailfish, Istiophorus orientalis; and broadbill swordfish, Xiphias gladius.

Strasburg, D. W.
1970. A report on the billfishes of the central Pacific Ocean. Bull. Mar. Sci. 20:575-604.

Interest in the 11 species of billfishes (blue marlin, Makaira nigricans; black marlin, M. indica; striped marlin, Tetrapturus audax; white marlin, T. albidus; shortbill spearfish, T. angustirostris; Mediterranean spearfish, T. belone; longbill spearfish, T. pfluegeri; Atlantic sailfish, Istiophorus americanus; Pacific sailfish, I. orientalis; Indian sailfish, I. gladius; and broadbill swordfish, Xiphias gladius) has steadily mounted since World War II, and, as they have come under increasing fishing pressure, arguments have arisen concerning the effects of fishing on their stocks. As large predators, the billfishes are difficult to study; our knowledge is largely restricted to catch statistics, anatomy, diet, and development of their young.

Uchiyama, J. H., and R. S. Shomura.
1974. Maturation and fecundity of swordfish, Xiphias gladius, from Hawaiian waters. In R. S. Shomura and F. Williams (editors), Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972, Part 2. Review and Contributed Papers, p. 142-148. U.S. Dep. Commer., NOAA Tech. Rep. NMFS SSRF-675.

Sixteen swordfish, Xiphias gladius, ovaries ranging in weight from 39 to 20,000 g were examined. Fish size ranged from 47 to 246 kg.

Wares, P. G., and G. T. Sakagawa.
1974. Some morphometrics of billfishes from the eastern Pacific Ocean. In R. S. Shomura and F. Williams (editors), Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972, Part 2. Review and Contributed Papers, p. 107-120. U.S. Dep. Commer., NOAA Tech. Rep. NMFS SSRF-675.

Length-weight and morphometric data collected over 4 years (1967-70) from sport fisheries at three eastern Pacific locations are presented for striped marlin, Tetrapturus audax; sailfish, Istiophorus platypterus; and blue marlin, Makaira nigricans. The data were gathered from San Diego, California (U.S.A.), Buena

Vista, Baja California, Sur (Mexico), and Mazatlan, Sinaloa (Mexico).

Yuen, H. S. H.
1980. A study of live and dead billfishes caught on longline gear. Southwest Fish. Cent. Admin. Rep. H-80-12, 10 p. Natl. Mar. Fish. Serv., NOAA, Honolulu, HI 96812.

This paper investigates some of the factors which may be related to billfish (blue marlin, Makaira nigricans; black marlin, M. indica; striped marlin, Tetrapturus audax ;shortbill spearfish, T. angustirostris; and sailfish, Istiophorus platypterus) being alive or dead at the time of boating.

Yuen, H. S. H., A. E. Dizon, and J. H. Uchiyama.
1974. Notes on the tracking of the Pacific blue marlin, Makaira nigricans. In R. S. Shomura and F. Williams (editors), Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972, Part 2. Review and Contributed Papers, p. 265-268. U.S. Dep. Commer., NOAA Tech. Rep. NMFS SSRF-675.

In July of 1971 and 1972 five Pacific blue marlin, Makaira nigricans, were tagged with temperature sensing, ultrasonic transmitters off the west coast of Hawaii.

FISHERY

Bartoo, N. W., and S. Ueyanagi (rapporteurs).
1980. Striped marlin, Tetrapturus audax. In R. S. Shomura (editor), Summary report of the Billfish Stock Assessment Workshop - Pacific Resources, p. 20-29. U.S. Dep. Commer., NOAA Tech. Memo. NMFS, NOAA-TM-NMFS-SWFC-5.

Review of fisheries data.

de Sylva, D. P.
1974. A review of the world sport fishery for billfishes (Istiophoridae and Xiphiidae). In R. S. Shomura and F. Williams (editors), Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972, Part 2. Review and Contributed Papers, p. 12-33. U.S. Dep. Commer., NOAA Tech. Rep. NMFS SSRF-675.

There is evidence that commercial fishing in the eastern Pacific is affecting the sport catches of sailfish, Istiophorus platypterus, and striped marlin, Tetrapturus angustirostris. Based on commercial catch data, the mean size of sailfish and striped marlin and their hooking rate have decreased. Sport fishing for billfishes poses special problems because of the complexity,

expense, expertise required, and lack of basic information on these fisheries and the fishermen. Possible solutions to these are discussed.

Hida, T. S., and R. A. Skillman.
1983. A note on the commercial fisheries in Hawaii. Southwest Fish. Cent. Admin. Rep. H-82-20 (Rev.), 9 p. Natl. Mar. Fish. Serv., NOAA, Honolulu, HI 96812.

*Commercial fish landings in the State of Hawaii for the 11 most important species are given for 1960, 1970, and 1980. Presented also are brief descriptions of the major fisheries accounting for these landings.

Huang, H. C.
1974. Billfish fishery of Taiwan. In R. S. Shomura and F. Williams (editors), Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972, Part 2. Review and Contributed Papers, p. 332-335. U.S. Dep. Commer., NOAA Tech. Rep. NMFS SSRF-675.

*Billfish landings made by Taiwan fishing vessels from 1962 to 1971 are analyzed and described briefly.

Ikehara, W. N.
1981. A survey of the ika-shibi fishery in the State of Hawaii, 1980. Southwest Fish. Cent. Admin. Rep. H-82-4C, 12 p. Natl. Mar. Fish. Serv., NOAA, Honolulu, HI 96812.

The rapidly growing ika-shibi, or night handline, fishery for tunas in Hawaii is described. Means of data collection, landings, and problems in present methods of data collection and burnt tuna are discussed.

Joseph, J., W. L. Klawe, and C. J. Orange.
1974. A review of the longline fishery for billfishes in the eastern Pacific Ocean. In R. S. Shomura and F. Williams (editors), Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972, Part 2. Review and Contributed Papers, p. 309-331. U.S. Dep. Commer., NOAA Tech. Rep. NMFS SSRF-675.

Catch and effort statistics from the Japanese longline fishery are used to examine the quarterly distribution of each of the six species of billfishes taken in the eastern Pacific Ocean east of long. 130°W.

Nakamura, E. L., and L. R. Rivas.
1974. An analysis of the sport fishery for billfishes in the northeastern Gulf of Mexico during 1971. In R. S. Shomura and F. Williams (editors), Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972, Part 2. Review

and Contributed Papers, p. 269-289. U.S. Dep. Commer., NOAA Tech. Rep. NMFS SSRF-675.

Data were obtained on the sport fishery for billfishes off South Pass, Louisiana and off northwest Florida in 1971. These data included: dates and times of raises; hookups, and catches by species; locations of raises; areas fished; baits used; water color; surface conditions; and boat characteristics.

Otsu, T.
1954. Analysis of the Hawaiian long-line fishery, 1948-52. Commer. Fish. Rev. 16(9):1-17. (Sep. 376.)

This report gives information on increase in tuna landings, change in the composition of catch, seasonality for tunas and marlins, and catch per unit of effort.

Sakagawa, G. T., and R. R. Bell (rapporteurs).
1980. Swordfish, Xiphias gladius. In R. S. Shomura (editor), Summary report of the Billfish Stock Assessment Workshop - Pacific Resources, p. 40-50. U.S. Dep. Commer., NOAA Tech. Memo. NMFS, NOAA-TM-NMFS-SWFC-5.

Review of fisheries data.

Squire, J. L., Jr.
1974. Angler catch rates of billfishes in the Pacific Ocean. In R. S. Shomura and F. Williams (editors), Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972, Part 2. Review and Contributed papers, p. 290-295. U.S. Dep. Commer., NOAA Tech. Rep. NMFS SSRF-675.

In 1969, 1970, and 1971 marine game fish anglers participating in a fish tagging program were asked questions concerning catches they made. From the 17,876 angler days reported, the catch consisted of 10,234 billfishes.

Squire, J. L., and Z. Suzuki (rapporteurs).
1980. Sailfish, Istiophorus platypterus, and shortbill spearfish, Tetrapturus angustirostris. In R. S. Shomura (editor), Summary report of the Billfish Stock Assessment Workshop - Pacific Resources, p. 30-39. U.S. Dep. Commer., NOAA Tech. Memo. NMFS, NOAA-TM-NMFS-SWFC-5.

Review of fishery data.

Tibbo, S. N., and A. Sreedharan.
1974. The Canadian swordfish fishery. (Abstr.) In R. S. Shomura and F. Williams (editors), Proceedings of the International Billfish

Symposium, Kailua-Kona, Hawaii, 9-12 August 1972, Part 2. Review and Contributed Papers, p. 296. U.S. Dep. Commer., NOAA Tech. Rep. NMFS SSRF-675.

Ueyanagi, S.
1974. A review of the world commercial fisheries for billfishes. In R. S. Shomura and F. Williams (editors), Proceedings of the International Billfish Symposium, Kailua-Kona, Hawaii, 9-12 August 1972, Part 2. Review and Contributed Papers, p. 1-11. U.S. Dep. Commer., NOAA Tech. Rep. NMFS SSRF-675.

This report reviews the commercial fisheries for billfishes. It also discusses the value and utilization of billfishes in Japan, and describes how billfishes have gained status as a quality fish, commanding prices comparable to the tunas. Expansion of the longline fishery is described.

U.S. National Marine Fisheries Service.
1982. The 1976-78 studies of the Kailua-Kona, Hawaii billfish fishery. Part I, Commercial/recreational component. Southwest Fish. Cent. Admin. Rep. H-82-3, 22 p. + append. Natl. Mar. Fish. Serv., NOAA, Honolulu, HI 96812.

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